MEETING SUMMARY
STAKEHOLDER ADVISORY GROUP
ETV WATER QUALITY PROTECTION CENTER
SHIP BALLAST WATER TREATMENT SYSTEMS

June 18, 2002
Alexandria, Virginia

Tom Stevens (NSF International) welcomed the participants to the second meeting of the Ballast Water Treatment Technologies Stakeholder Advisory Group and read the NSF anti-trust statement. He explained the objectives for the meeting:

- update the stakeholders on the status of Environmental Technology Verification (ETV) activities with respect to ballast water treatment technologies,
- review the ballast water protocol as currently written, to discuss other organizations' ballast water activities to date, and
- obtain stakeholder input regarding funding sources.

Self-introductions were made by all of the meeting participants. A list of meeting participants is attached.

ETV Program Update

For the benefit of those who were unable to attend the previous meeting, Ray Frederick (USEPA) summarized the goals and history of the ETV Program. The ETV Program was designed to promote marketplace acceptance of environmental technologies that protect human health and the environment. This is achieved by generating objective, third-party performance data for the environmental technologies. The ETV Program evaluates (e.g., measures, estimates, tests) and verifies (e.g., confirms, substantiates) how well various treatment technologies perform given a specific set of conditions and parameters. By using standard test protocols written with stakeholder input, vendors are assured of a "level playing field". Participation in the ETV Program is voluntary and, as the results of the verification test are made publicly available, is intended for commercial-ready technologies only, as the ETV Program is not intended as a research tool for technology performance. The results obtained during testing will be published, regardless of the performance of the technology. The ETV Program does NOT certify (e.g., warranty or guarantee) any of the technologies it tests, and is not to be mistaken for an approval process.

Mr. Frederick explained that the ETV Program was originally set up to include twelve pilots programs, addressing all the major areas of environmental concerns, from air pollution control to drinking water. Although the focus of the Program is still broad following the pilot period, the Program has been restructured to include six "centers":

- Air Pollution Control Technology
- Drinking Water Systems
- Greenhouse Gas Technology
- Advanced Monitoring Systems
- Water Quality Protection

- Pollution Prevention (P2), Recycling, and Waste Treatment

The ETV Water Quality Protection Center was formed by combining the Source Water Protection Technologies and Wet Weather Flow Technologies pilots. In light of the events of the past year, there is also increasing focus within the ETV Program on technologies that play a role in homeland security. Near-term needs of the Water Quality Protection Center will include strengthening partnerships with other potential funding partners (e.g., Federal agencies, State agencies, private sector) and balancing the makeup of the stakeholder group, in particular, recruiting representatives from the environmental and financial communities.

Source Water Protection Pilot (Water Quality Protection Center) Update

Tom Stevens briefly reviewed the various technology areas addressed by the Source Water Protection Pilot. These include decentralized wastewater treatment, urban infrastructure rehabilitation, watershed protection, and ballast water treatment. Information related to ETV activities in these technology areas can be found at http://www.epa.gov/etv and http://www.nsf.org/etv. Although ships traveling within the Great Lakes have been subject to the Nonindigenous Aquatic Nuisance Prevention and Control Act since 1990, increased awareness of the problems associated with the influx of aquatic nuisance species in ship ballast water led to the passage of the National Invasive Species Act (NISA) in 1996. NISA requires that ships from foreign waters docking in the U.S. provide information to the United States Coast Guard (USCG) on their ballast water management practices. At the same time, it is requested that ships follow voluntary guidelines to reduce the numbers of foreign aquatic nuisance species introduced to U.S. waters. These voluntary practices could include ballast water exchange in the open ocean, retaining ballast water for the duration of a ship's stay in U.S. waters, or treatment of the ballast water prior to discharge. However, ballast water exchange has not been proven effective (e.g., some organisms will remain in the ship's ballast tank even after exchange, many ships are not designed to withstand the stress associated with a mid-ocean exchange, ballast water exchange should not be performed in inclement weather). The development of new treatment technologies is a challenge due to the variety of species and large volume of water involved. Because of these concerns, the ETV Program is collaborating with the USCG to develop a protocol for evaluating ballast water treatment technologies. A draft protocol should be available for review by September 2002. A goal of September 2003 has been set for the initiation of testing.

IMO Activities

Commander Scott Newsham (USCG) briefly discussed international activities related to ballast water treatment. The International Maritime Organization (IMO) is the United Nations specialized agency responsible for improving maritime safety and preventing pollution from ships. The IMO Marine Environment Protection Committee (MEPC) is a technical body focusing on marine pollution related matters. MEPC's first objective in response to the proliferation of nonindigenous organisms was to have ships perform ballast water exchanges. The effectiveness of ballast water exchange is variable according to several factors, including the type of ship, the ballast tank design, and time of year. A working group with MEPC is developing an international convention to address ballast water treatment. The major obstacle to concluding an international agreement remains the absence of a ballast water treatment standard. Currently, the group is considering a variety of standards. While 95% removal/inactivation of unwanted organisms and pathogens has received international support, the biological effectiveness of this is not viewed by

some countries as scientifically supportable. MEPC has set a goal to have a treaty signed in the fall of 2003. The next meeting of the MEPC is the first week of October.

USCG Ballast Water Management Program

Rich Everett discussed the USCG ballast water management program. The goals of the USCG program are threefold: to develop a voluntary exchange program, followed by approval of experimental ballast water treatment systems and the creation of ballast water discharge standards. When the National Invasive Species Act of 1996 (NISA) was enacted, it mirrored one already in place in the Great Lakes, only that the Great Lakes program is mandatory. NISA directed the Secretary of Transportation to implement voluntary national ballast water management guidelines. Following a twenty-four to thirty month period, the Secretary would prepare and submit a report to Congress assessing compliance with the guidelines and establishing the rate of compliance. USCG implemented the guidelines in July 1999 and the Secretary presented the report to Congress in June 2002. Primary data used in the USCG report were obtained from the National Ballast Survey (NABS) and included information regarding compliance with ballast water reporting requirements and patterns of ballast water distribution. The study concluded that nationwide compliance with required ballast water reporting was only 30.4% (this was not surprising, since there were no penalties for not reporting). Reporting compliance was so low that the data cannot really be used to extrapolate conclusions about industry activities as a whole. However, the results of analysis of the small data set are: 73.6% of ships had no intent to discharge ballast water due to itinerary, etc. and 26.4% intended to discharge foreign ballast (about half of these actually performed an exchange). This means that 86.6% of ships reporting indicated they had followed the voluntary guidelines by retaining or exchanging ballast water. By percent volume discharged, about 37 million metric tons of discharged ballast water are reported nationally. Of that volume, 68.7% is reported exchanged and 29.7% is reported unexchanged. It was concluded that in instances where mid-ocean exchanges were not performed, only 4.6% of the vessels cited safety concerns or some variant. The most frequent reason was that the ship's itinerary precluded such an operation, for example, the trip was too short, the route did not include areas meeting criteria for exchange (200 miles from shore and 2,000 meters deep). These results were compared to the mandatory Great Lakes program, in which 100% of regulated ships submitted reports, 93% of regulated ships performed ballast water exchange, and 7% of regulated ships did not perform ballast water exchange, in which case alternative actions were required to meet the regulations.

As recommended in the report to Congress, initial USCG regulatory steps include: 100% of vessels with ballast tanks will be required to report (including those after operating in the EEZ and voyages between U.S. Ports), vessels with ballast tanks entering from beyond the EEZ will be required to conduct active ballast water management, and sanctions in 1101(g) of NISA will be enforced for failure to comply. Safety exemption criteria have not yet been established, but there will likely be stricter enforcement to ensure that vessels do not use this reason in order to unnecessarily avoid ballast water exchange. Future USCG actions as discussed in the report to Congress also include making EPA a cooperating agency. Continuing efforts will establish an approval for experimental shipboard ballast water treatment systems, a quantitative ballast water treatment standard, and protocols for testing ballast water treatment technologies.

Program for Advance Approval of Experimental Systems Installed on Operating Vessels

As one of the goals arising from the report to Congress was a national ballast water management program fostering the development of new ballast water treatment technologies, the Program for Advance Approval of Experimental Systems Installed on Operating Vessels was designed. This program is targeted at ship owners (approvals will be on a ship by ship basis). Ship owners want to know that the technology they are purchasing and installing will be approved, and this program provides assurances that for a fixed time period (as yet undetermined), they will be compliant with regulations. A review panel will review each system prior to approval. Review criteria include letters of commitment, a system description for all components, environmental compliance documentation, prior experimental results, and a proposed study plan. If the technology is approved, testing must begin within one year. Follow-up activities would include the submission of reports, vessel inspections, and determination that the technology has no adverse effects on ecology or human health. The process would allow for different ships to use similar technologies, providing data on how the technology performs under different conditions.

Ballast Water Discharge Standards

There is a need for assurance that any ballast water discharge standards are no less effective than the practice of ballast water exchange. Alternative ballast water treatment methods will be at least as effective as ballast water exchange if they produce predictable results, remove or inactivate a high proportion of organisms, function effectively under most operating conditions, and support the Congressional intent to eliminate ballast water discharge as a source of harmful NIS. Several alternative long-term goals and interim standards have been suggested, and the Coast Guard has asked for comments on these options in a Federal Register Notice. The alternative goals are: (1) no discharge of zooplankton and photosynthetic organisms: *Enterococci* and *E. coli* are not to exceed 35 per 100 mL and 126 per 100 mL, respectively, (2) treat to at least the same extent as drinking water (with respect to organism inactivation), and (3) compare treatment technologies directly with ballast water exchange.

The various interim standards being discussed are: (1) 95% removal, kill or inactivation of representative species, (2) removal, kill, or inactivation of all organisms larger than 100 microns or 50 microns (two proposals), (3) removal, kill, or inactivation of 99% of all coastal zooplankton, 95% of all photosynthetic organisms, and *Enterococci* and *E. coli* shall not exceed 35 per 100 mL and 126 per 100 mL, and (4) no organisms greater than 50 microns in size shall be discharged, and *Enterococci* and *E. coli* shall not exceed 35 per 100 mL and 126 per 100 mL.

MARTOB Activities

Rich Everett (USCG) described activities related to a European program titled Onboard Treatment of Ballast Water and Application of Low-sulphur Marine Fuel (MARTOB) and Singapore's Institute of Environmental Science and Engineering (IESE). MARTOB is a three-year project funded by European Commission (3.5 million euros). With respect to ballast water, the goals of MARTOB are similar to those of ETV, but they also include the development of onboard treatment equipment, the production of guidelines for crew training, and the development of criteria for selecting an appropriate management method. MARTOB is a public-private partnership with 25 partner organizations, including universities, government and private research institutes, ship owners, maritime industry associations, and environmental engineering companies. The initial set of treatment methods selected by MARTOB include thermal

treatment, deoxygenation, UV/US and ozone systems, oxicide, and hurdle (combination) technologies. Development of standard test organisms to date includes calanoid copepods (*Acartia sp.*), harpacticoid copepods (*Tisbe sp.*), larvae of benthic spp. (*Nereis virens*), diatoms (*Thallasosira sp.*), and dinoflagellates (*Alexandrium sp.*). A meeting participant noted that, since *Enterococci* would be picked up in any offshore waters, it would be a good indicator organism.

The Institute of Environmental Science and Engineering (IESE) in Singapore is also conducting research related to ballast water. In particular, IESE is researching treatment technologies, indicator species, and testing methods. For more information on some of the programs discussed during Mr. Everett's presentation, please refer to:

USCG ANS Program	www.uscg.mil/hq/g-m/mso/mso4/
Department of Transportation Docket	http://dms.dot.gov/
National Ballast Information Clearinghouse	http://invasions.si.edu
MARTOB	www.marinetech.ncl.ac.uk/research
IESE	www.eti.org.sg

ETV Ballast Water Protocol

Deb Tanis and Carlton Hunt (Battelle) provided an update on the status of the ETV protocol for ballast water treatment technologies. Ballast water treatment technologies addressed by the protocol must be prefabricated, commercial-ready treatment systems. Systems that provide only partial treatment are excluded from the protocol. The protocol, once finalized, will provide guidance to testing parties on the required guidelines for verification testing. Subsequent product-specific and site-specific test plans will be developed for each evaluation in accordance with the guidelines presented in the generic protocol. The protocol development process has been complex because it needs to be adaptable to multiple treatment types, address multiple treatment processes/configurations (in-tank and in-line), represent a broad range of water quality characteristics, and evaluate a broad range of organism types/species. The protocol addresses six different treatment configurations (under fresh or salt water conditions for systems treating on uptake, systems treating on discharge, and systems treating within the tank). The protocol also includes challenge conditions simulating a range of "most challenging" natural conditions and identifies functional organism types, which are resistant to treatment, for use in the test challenge water. Verification factors identified in the protocol include biological treatment performance (verification of removal, kill, or inactivation of bacterial, protist, and zooplankton species), operation and maintenance considerations (including usefulness of O&M manual), reliability, cost factors, environmental acceptability, and safety.

The challenge water quality conditions specified by the protocol should be difficult to treat but representative of the natural environment, excluding extreme or very rare conditions. Both marine and fresh challenge waters are described in the protocol, along with water quality parameters for each, including DOC (dissolved organic chemicals), POM (particular organic matter), and MM (mineral matter) levels. The DOC, POM, and MM levels represent high particulate conditions. Biological challenge conditions are also detailed in the protocol, including different bacteria, zooplankton, and protist species for fresh and salt water. The Ballast Water Technical Panel is currently in the process of making the final determination regarding which indigenous and surrogate (spiked) organisms to use for the challenge water. Following that determination, the Panel will determine how to introduce the organisms and at which stage of their development. The Panel has determined threshold concentrations for indigenous species. Surrogate additions will be in concentrations equal to the threshold levels.

Key considerations with respect to the testing approach are the statistical validity, test duration and reliability, variability of treatment effectiveness over time and temperature range, and how to simulate voyage conditions, including tank volume, flow rate, and time in ballast tank. Several meeting participants noted that the question of whether the proposed approach is reasonable is directly related to the level of financial assistance that will be received.

Effluent from the technology undergoing evaluation will be tested to determine the viability of any organisms remaining following treatment. Another important consideration for the treated water is the presence of residuals, such as biocides.

During the protocol development process, several research needs have been identified, especially the identification of Dinoflagellate indicator species, scale-up of culture methods, comparative sensitivity of proposed indicator species, and selection/development of rapid viability analyses (methodologies that can be performed in lieu of full enrichment).

There was a question regarding whether the ETV effort will combine with the USCG standard at some point. Mr. Everett explained that programmatically, he suspected that the two would want to remain separate, but there is no reason why protocols and test plans could not be carried over from one program to another (for example, from ETV to a regulatory program). The group agreed that there should not be onerous duplication of effort.

The subject of shipboard vibrations was discussed. Since the protocol specifies that testing be conducted on land, there were concerns about whether the effect of vibrations on technology performance would be evaluated. It was suggested that some on-board studies be conducted later on. Bill McCracken (Michigan DEQ) explained that in his experience (in Michigan), there are too many variables with on-board testing and that he supports the way in which the ETV protocol is set up to conduct testing under controlled conditions.

Another meeting participant suggested that the results of verification testing would only be comparable if testing a technology that treats on discharge. For systems that treat in the tank or on uptake, there are an infinite number of potential tank configurations. In response, it was noted that ETV does not certify technologies. It does, however, verify a given technology's performance under specific test conditions. Some professional judgments will have to be made when determining whether a treatment technology is going to be effective on a particular ship, since ships are never in port long enough to collect samples and then grow cultures. The goal of technology verification is to provide some assurance that technologies do what they say they will.

There was support from several meeting participants for onboard testing. They expressed their concerns that verifications conducted through the ETV Program will not provide the data they want. Mr. Stevens reviewed the goals of the ETV Program, and explained that it is designed to provide useful data to regulators, users, vendors, engineers, etc. However, the ETV Program is not designed for use in lieu of regulatory acceptance. Mr. Stevens stressed the value of verification data that, because of standardized test methods, will be comparable. In addition, the draft ballast water protocol was developed to be affordable to technology manufacturers. Based on the results of the first round of testing, the protocol may be revised; it is a living document and efforts should be taken to ensure that it is practical.

Possible Ballast Water Test Sites

Lieutenant Commander Jim Hurley (USCG) discussed possible ballast water treatment technology sites. He began looking into potential test sites following the signing of the USCG/EPA agreement and the first ETV Stakeholder Advisory Group meeting. At that time, he wrote a general facility description, with nine elements, and sought outlets to publicize the need for test sites. The nine elements originally identified included: a water source (either marine or fresh), a water delivery system and discharge system, sample holding tanks, water holding tanks, monitoring system, biological testing laboratory, capability to culture organisms, shipping port access, and be enclosed (for year-round testing). After receiving responses to a "sources sought" announcement in Commerce Business Daily and other published announcements, it was determined that no facility met all of the requirements. At that time, LCDR Hurley revisited the factors making up the facility description. He deleted the requirements for shipping port access (as it is not a factor in the protocol being developed) and for an all-weather enclosure, and added available space and on-site support as requirements. At that time, the applicant field was narrowed to five potential test sites, having capabilities in most of the specified areas. Some of the applicants included:

Naval Research Lab (Key West) – would need to bring biological analytical capabilities to site. LCDR Hurley had an impression of their facility as being quite self-sufficient overall (including a seawater pump system up to 4,000 gpm, a seawater chemistry laboratory in place, and water holding tanks on hand).

University of Minnesota (St. Anthony Falls Laboratory) - this site, founded in the 1930s at the base of a 50 foot drop in the Mississippi River, has fresh water available at large flow rates, biological capabilities and large water holding tanks on site. The laboratory was previously used as a test site for the ETV Drinking Water Pilot.

Moss Landing Marine Laboratory - an environmental biotechnology laboratory with a partnership with Monterey Bay Aquarium Research Institute. The site has sufficient water available for testing from deep seawater intakes. Remote monitoring and control w/PC and backup electrical power are available.

Aquatic Sciences Inc. - located in Canada and specializes in environmental and marine science. This site previously conducted a ballast water study for the Canadian Coast Guard (1994-95) and the in-place system could be modified.

LaQue Center for Corrosion Technology, Inc. - a corrosion testing and consulting organization in North Carolina. They have a seawater pump system that can handle approximately 3000gpm. LaQue would have to partner with a local university (or another organization) for biological testing.

Aberdeen Test Center - a diverse Defense Department Test and Training Facility with very large manmade ponds that have been used for underwater explosion tests. This site also consists of a piping system test pad and large capabilities in logistics and fabrication support.

Few potential test facilities had large water storage tanks. The selection of test facilities should also be based on the availability of discharge permits depending on the surrogates used. The most important capabilities include interest in the ETV Program, available space, ability to form and work within partnerships, and a facility with its own sustaining interest, too.

The next step is to consider how to proceed. Possible avenues include a government contract with RFP (may exclude some of the government facilities), MIPR (government to government funds transfer), or a grant (this may pose a greater risk to the project). To better define the needs of the program with respect to choosing a test facility, one could better define the source water needed and whether discharge permits will be available.

National Oceanic and Atmospheric Administration (NOAA) Ballast Water Activities

Dorn Carlson (NOAA) presented information about NOAA's Nonindigenous Species Research and Outreach Programs. The Ballast Water Technology Demonstration Program is a competitive R&D grant program ($2.1 million are available) with emphasis on the Great Lakes and Chesapeake Bay. Through it, a variety of different technologies have been studied, such as physical separation and biocides. Proposals for money or for testing on a Department of Transportation Maritime Administration (MARAD) ship are currently being requested for technologies in all stages of development. See www.nsgo.seagrant.org/research/nonindigenous for more information. The money available has not been sufficient to run a shipboard testing to date, however, the maximums were raised this year. The current request for proposals covers basic or applied research, and is designed to address all phases of development - proof of principle, lab experiments, pilot scale, full scale, etc.

Technology manufacturers may also apply for a grant through Sea Grant Aquatic Nuisance Species Program. Sea Grant expects to provide a total of about $5.6 million to support projects in the aquatic nuisance species research and outreach area over a two-year period (FY2003 and FY2004). Matching funds equal to a minimum of 50% of the Federal request will be required.

Other Testing Activities

Bill McCracken (Michigan Department of Environmental Quality) discussed the ballast water program in Michigan. By March 1, 2002, the following tasks were to have been completed: determine whether ballast water management practices are being carried out by individual ships (both for ships that stay within the Great Lakes and those that spend time in the ocean) and determine whether one or more technologies could further prevent the introduction of species to the Great Lakes. By March 2003, MDEQ was supposed to determine whether oceangoing vessels are using the treatment technologies recommended the year before. MDEQ contracted with Fleet Technology last year for biocide testing. Onboard system testing and laboratory toxicity and corrosion testing were conducted to determine the effects of biocides, sodium hypochlorite and copper ion (used as anti-fouling agents on ships), on the ballast water, the environment, and the ship itself. Testing was conducted in both fresh and salt-water mediums. The Michigan Environmental Science Board (MESB) reviewed the findings. A small amount of corrosion was found with each biocide, but it was surmised that this corrosion would not significantly affect the life of the ship. There are some safety issues associated with the handling of hypochlorite. Since hypochlorite can be dechlorinated, however, it is not as much of a discharge concern as copper ion. Sediments seriously hinder the effectiveness of both biocides. Within species, eggs and cysts were found to be significantly more resistant than the adult organisms. The method of biocide application was determined to be another important consideration. Because of the lack of organisms in some of the ballast water taken on during testing, it was suggested that laboratory work is meaningful when evaluating ballast water treatment technologies.

Allegra Cangelosi (Northeast-Midwest Institute) discussed a bench-scale evaluation of a UV system as a ballast water treatment technology in 2001-2002 at Marrowstone Field Station in Puget Sound. Conventional UV treatment research apparati were used to investigate UV's strengths and weaknesses when treating ballast water. The effectiveness of UV against bacteria, phytoplankton, and zooplankton was evaluated. It was determined that bacteria and phytoplankton are more sensitive to UV than zooplankton. Sub-lethal doses induce stress effects (e.g. reduced activity, spawning), underscoring the need for pretreatment. The effects of repetitive low doses could be additive (UV applied in series or at both intake and discharge). The apparati were not as useful for handling active zooplankton. For shipboard demonstrations, they are considering installing a depth filter and UV system. A UV system and cyclonic separator are currently installed on M/T Aspiration.

Andrew Rogerson (Nova Southeastern University) discussed onboard testing on Elation (a Carnival Cruise Line ship). The ballast water treatment system on the ship was a continuous electro-ionization system. Based on the design of the ballast water tank it was determined that there was a lot of dead space. However, due to Carnival Cruise Line's concerns, sampling directly from the tank was not permitted (samples were taken following the pump, prior to treatment, and following treatment, before the ballast water returned to the tank). The following conclusions were noted. Over twenty hours of continuous operation, the electro-ionization system produced better than 95% kill of all culturable bacteria, protozoa, and algae. However, after this time, regrowth was dramatic, probably related to unscheduled down times of the system. Testing onboard is fraught with problems, but if testing focuses on the enormous number and diversity of indigenous bacteria and protists, verification can be successful. Bromoform was detected below drinking water standards in the residue.

Thomas Waite (University of Miami) discussed his research on the effects of turbidity on entire treatment train, including UV radiation. Testing was completed last fall and the report is under review by USCG.

NISA Reauthorization

Although a bill has not yet been introduced, Ms. Cangelosi explained that it should better define an interim standard for alternative treatments, that a final standard should be based on biological reduction, and the bill should also address areas of the ship other than the ballast tank where nonindigenous organisms could be harbored (anchor, chain, hull, etc.) For domestic coastwise traffic, the date required for treatment would be likely be further in the future, but reporting requirements would be immediate.

Funding Sources

The final discussion of the day focused on potential funding sources for establishing the test facilities and conducting testing. The cost for both efforts could be significant, and funding is limited through the ETV program. Possible sources of funding were mentioned, including USCG and NOAA/Sea Grant. These programs, while potential sources of funding, are under budgetary pressures and probably would not have the funding needed to support the costs. Mention was made of the Harbor Maintenance Tax fund, which is generated by a tax imposed on imports into the U.S. and used for maintenance such as dredging. There is a considerable amount of money generated each year from the fund ($800 - $900 million), with a portion actually used for

maintenance and the excess (up to $300 million annually) placed in the fund. While there is a large amount in the fund (possibly billions), access to the fund may be difficult.

Peter Jenkins, Attorney/Policy Analyst for the International Center for Technology Assessment, presented his thoughts on possible invasive species control funding. His presentation was based on a paper he developed entitled "**Who should pay? A proposal for legislation to apply the Polluter Pays Principle to biological pollution through a fee-based Invasive Species Prevention, Quarantine and Control Trust Fund." A copy of the paper may be obtained by contacting Mr. Jenkins at** peterjenkins@icta.org. The discussion that followed focused on whether another fee, on top of all fees shippers currently have to pay, would be acceptable. It was generally felt that there would be resistance to the idea, but that efforts should be made to begin discussions with elected officials to consider funding ballast water treatment efforts.

Meeting Conclusion

Tom Stevens indicated that there had been no scheduled date for the next stakeholder meeting, but that it would probably be in about a year. The meeting was then adjourned.

Attachment 1

Meeting Participants
for the Stakeholder Advisory Group
ETV Water Quality Protection Center
Ship Ballast Water Treatment Systems

Participant	Organization	Classification
Ray M. Frederick	US EPA - Office of Research and Development	Federal agency
Richard Everett	US Coast Guard	Federal agency
Tom Grant	Lifespan	Vendor
Fred Tsao	US Navy	Federal agency
Robert Odette	US Navy Environmental Health Center	Federal agency
Marcus Allhands	Amiad Filtration Systems	Vendor
Jon Stewart	Marine Environmental Partners, Inc.	Vendor
Andrew Rogerson	NOVA Southeastern University	Academia
Birgir Nilsen	Optimarin AS	Vendor
Mattias Voight	Dr. Voight Consulting	Consultant
Bonnie Ram	Energetics Inc.	Vendor
Debra Aheron	MARAD	Federal agency
Alexander Lardis	ONR	
Dawn Schroeder	U.S. Navy	Federal agency
Eric Holm	U.S. Navy	Federal agency
Paul Schatzberg	NACI	
Dean Putnam	NACI	
Bill McCracken	Michigan DEQ	State agency
Scott Smith	Washington Department of Fish and Wildlife	State agency
Dave Stamper	U.S. Navy	Federal agency
Tom Waite	University of Miami, Florida	Academia
Melissa Law	Baker Petrolite	Vendor
Tom Maddox	TL Maddox Companies	Vendor
Mark Burrows	International Joint Commission	International agency

Hue To Robinson	Nutech O3, Inc.	Vendor
Jack Robinson	Nutech O3, Inc.	Vendor
Michael Jennings	Nutech O3, Inc.	Vendor
Joel Mandelman	Nutech O3, Inc.	Vendor
Penny Herring	US Coast Guard	Federal agency
Gail Roderick	US Coast Guard	Federal agency
Bivan Patnaik	US Coast Guard	Federal agency
Will Browning	Browning Transport Management	Vendor
Scott Newsham	US Coast Guard	Federal agency
Liz Walker	Alcalde & Fay	Attorney
Emily Durham	Tandem Technologies, Inc.	Vendor
Melissa Scanlon	Ungaretti & Harris	Attorney
John Heisler	USEPA	Federal agency
Gregory Claffey	PCI-Wedeco	Vendor
Garth Jensen	US Navy	Federal agency
Peter McNulty	NEI Treatment Systems	Vendor
George Silva	US Coast Guard	Federal agency
David Wright	University of Maryland	Academia
Kathy Metcalf	Chamber of Shipping of America	Trade organization
Kurt Powers	BMT Designers & Planners, Inc.	Consultant
Larry Russell	Exostop	Vendor
Garry Smythe	Beak Environmental Specialists	Consultant
Allegra Cangelosi	NE-MW Institute	Organization
Dorn Carlson	NOAA	Federal agency
Gavin O'Hare	ONDEO Nalco	Vendor
Mario Tamburri	University of Maryland	Academia
Alan Fleischer	Scienco/FAST	Vendor
Robert Weddle	USFilter	Vendor
Fred Smith	SciReg, Inc.	Consultant
Robert Lyles	Tandem Technologies, Inc.	Vendor
Joseph Schuermeyer	Tandem Technologies, Inc.	Vendor